Promass 100 Flowmeter via EtherNet/IP to the PlantPAx Process Automation System

Endress+Hauser
People for Process Automation

Allen-Bradley • *Rockwell Software*

Rockwell Automation

Preferred Integration

Rockwell Automation and Endress+Hauser have strengthened their strategic alliance to provide complete process automation solutions that use best-in-class instrumentation, software, and control systems.

There are hundreds of different components in a typical plant: controllers, remote I/O, electrical drives, safety equipment, and sensors. Each must be integrated, configured, and optimized during start-up and operation. Recognizing the challenges this creates, Rockwell Automation and Endress+Hauser are focused on providing scalable, off-the-shelf solutions.
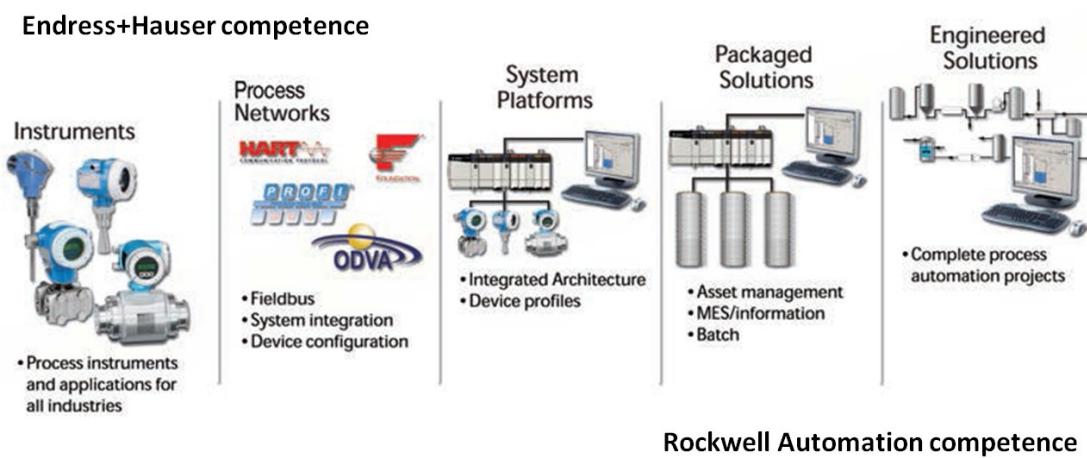
To reduce the risks associated with integrating many devices from many different suppliers, Rockwell Automation pretests many third-party manufactured HART, FOUNDATION Fieldbus, EtherNet/IP, and PROFIBUS PA field devices in the system test laboratory for compatibility with the Rockwell Automation PlantPAx automation system. Each field device is connected to the PlantPAx system and is subjected to interoperability testing procedures similar to operating procedures in your plant. The results of each field test are recorded in a test report for integration planning purposes.

For Endress+Hauser field devices, an additional step provides an "Integration Document" and "Interoperability Statement" for each tested instrument. The Integration Document provides information on installation, configuration, startup, and operation of the integrated system. The Interoperability Statement is assurance that the Endress+Hauser field device meets PlantPAx system interoperability performance measures, as jointly established by Rockwell Automation and Endress+Hauser and verified through completion of common test procedures performed by either company. Both the Integration Document and Interoperability Statement help reduce risk and provide ease of integration.

The overall mission of the alliance is to provide proven solutions that combine field instrumentation with fieldbus networks, such as HART, FOUNDATION Fieldbus, PROFIBUS PA, and EtherNet/IP networks, with asset management capabilities and Rockwell Automation's system capabilities to provide a total engineered solution.

Through preferred integration and support of increasing requirements for plant-wide control, the alliance offers the following benefits:

- Reduced integration costs throughout engineering, commissioning, and start-up
- Optimized plant availability and output
- Ensured product quality and consistency
- Optimized traceability to meet regulatory demands
- Predictive maintenance through intelligent instruments

For new construction, process improvements at an existing plant, or operating cost reductions, the alliance delivers the following:

- Certified integration reduces risk, reduces integration costs, and protects investment with pre-engineered interoperability.

  Both companies believe open systems and standardized interfaces bring maximum benefits.

- Advanced capabilities with plant-wide asset management provides better visibility of plant health and easier access to instrument diagnostics, which ultimately leads to faster troubleshooting and improves decision-making.

PlantPAx
Process Automation System

Application Overview

This document provides a step-by-step approach to integrating an Endress+Hauser Promass 100 Coriolis Mass Flow Measuring System into a Rockwell Automation PlantPAx process automation system via EtherNet/IP.

This Section	Describes
Application overview	Details about the field instrument and control system.
System details	Specifications on the required hardware and software components.
Installation	How to connect the measurement instrument to the EtherNet/IP interface.
Configuration (two separate sections)	How to: • Configure the EtherNet/IP interface. • Configure the measurement instrument.
Visualization	How to implement and configure a graphical display of device information.

The ControlLogix platform provides a robust EtherNet/IP backbone for communication to process fieldbus networks. The PlantPAx system architecture uses producer/consumer technology, allowing input information and output status to be shared by all ControlLogix controllers in the system.
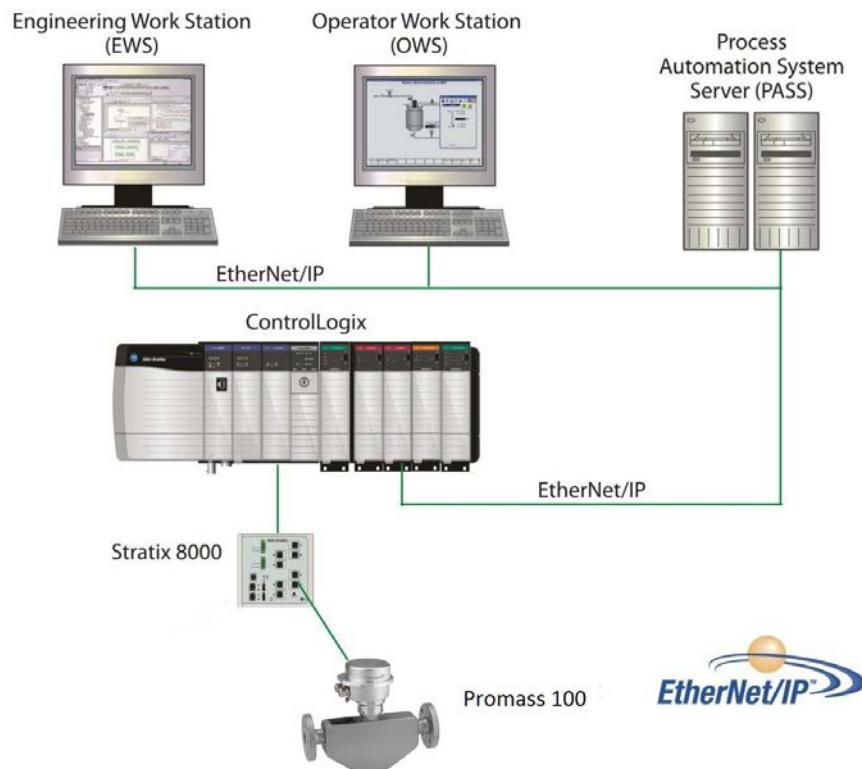

This integration document assumes you have a working knowledge of ControlLogix systems. For more details regarding the equipment and tasks described in this document, see Additional Resources on page 38.

Promass Flowmeter

Promass measuring instruments make it possible to simultaneously record several process variables (mass/density/temperature) for various process conditions during measuring operation. Promass sensors, tried and tested in over 100,000 applications, offer the following:

- Multivariable flow measurement in compact design
- Insensitivity to vibrations thanks to balanced two-tube measuring system
- Immunity from external piping forces due to robust design
- Easy installation without taking inlet and outlet runs into consideration

The measuring principle is based on the controlled generation of Coriolis forces. In the sensor, two parallel measuring tubes containing flowing fluid oscillate in antiphase, acting like a tuning fork. The Coriolis forces produced at the measuring tubes cause a phase shift in the tube oscillations. At zero flow, when the fluid is at a standstill, the two tubes oscillate in phase (1). Mass flow causes deceleration of the oscillation at the inlet of the tubes (2) and acceleration at the outlet (3).
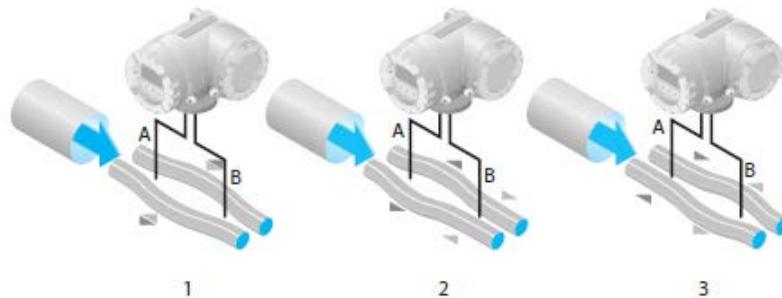
The phase difference (A-B) increases with increasing mass flow. Electrodynamic sensors register the tube oscillations at the inlet and outlet. System balance is ensured by the antiphase oscillation of the two measuring tubes. The measuring principle operates independently of temperature, pressure, viscosity, conductivity, and flow profile.

Measured Variables

- Mass flow (proportional to the phase difference between two sensors; mounted on the measuring tube to register a phase shift in the oscillation)
- Volume flow (calculated from mass flow and fluid density; the density is proportional to the resonance frequency of the measuring tubes)
- Measuring tube temperature (by temperature sensors) for calculatory compensation of temperature effects
- Density (by monitoring the tube frequency; is directly proportional to medium density)
- Totalized flow

Instrument Specifications

- Communication: Standard, EtherNet/IP™ up to 100 Mbps
  - ODVA™ compliant
  - IEEE 802.3
- Supply voltage: 20 to 30 VDC
- Ambient temperature: -40 to +60 °C (-40 to +140 °F)
- Degree of protection: IP 66/67 (NEMA 4X)
- Approvals: CE marked for nonhazardous area application
  - ATEX/IECEx
  - $_c$CSA$_{US}$
- EMC: IEC/EN 61326 and NAMUR Recommendation NE21
- Device configuration: Multiple options
- Ethernet connection: Bus Plug: 4-pole M12 connector per IEC 61076-2-10
- IP Addressing: Configurable EtherNet/IP and Web server addresses
  - Hardware device addressing by DIP switches
  - Software device addressing by integrated Web server
  - DHCP or Static IP addressing supported
- Status condition: Four LEDs for communication status
- Security: Password protected with four definable levels
- Data mapping: (16) Autoscan registers for data transmission:
  - Preconfigured for easy integration but can be user-defined
  - Positions 1 to 10 for input value reporting
  - Positions 11 to 16 for output control
- Integrated Web server: Operation supported in standard web browser
- EDS file: Embedded in the device for RSLogix 5000 integration
- Add-on profile: Available for Promass 100 with EtherNet/IP

IMPORTANT   The use of DLR requires Stratix 4000 EtherNet Tap.

Control System

The control system includes these components:

Component	Description
Controller	The Logix controller is a modular, high performance controller, which uses RSLogix 5000 programming software to configure, program, and monitor a system.
EtherNet/IP Communication	The EtherNet/IP Communication Module serves as a linking device/bridge module. Seamless integration into control systems with direct EtherNet/IP connection, e.g., ControlLogix, CompactLogix or PlantPAx from Rockwell Automation is possible.
Programming software	PlantPAx is an easy object-oriented, explorer-based, drag-and-drop configuration that allows you to build complex process functions. Furthermore, the software allows you to mix and match IEC61131-3 compliant programming languages. All supported programming languages share the same development environment, tag database, and user interface, resulting in reduced training and higher productivity.
Visualization software	FactoryTalk® View Site Edition software is an HMI software program for monitoring, controlling, and acquiring data from manufacturing operations throughout an enterprise. A faceplate provides a graphical representation of the instrument through the Operator Work Station. Faceplates associated with every instruction help you set up, tune, and control the element with a minimum of effort. Additions and modifications can be performed online, while your process keeps running.

Example System

Endress+Hauser and Rockwell Automation interoperability testing is performed for every new device and product.

Hardware Components

Component	Catalog Number
Promass 100 Coriolis Flowmeter	8F1B08-*N******-****
EtherNet/IP Communications Module	1756-EN2T
ControlLogix Control System	1756-L63

For further details, see the PlantPAx Process Automation System Selection Guide, publication PROCES-SG001-EN-P.

Software Components

Component	Catalog Number
PlantPAx	
RSLogix 5000 Enterprise Series programming software, Professional edition Includes: • RSLinx Classic software • RSLinx Enterprise software	9324-RLD700NXENE
FactoryTalk View Site Edition (SE) software (optional)	9701-VWSXXXXXENE
FactoryTalk AssetCentre server (optional)	9515-ASTSRVRENE
FactoryTalk AssetCentre process device configuration (optional)	9515-ASTPRDCFENE
E+H FieldCare Standard Asset Management software (optional)	SFE500

For additional information on drivers, see Additional Resources on page 34.

For specifications of the engineering workstation (EWS) and operator workstation (OWS), see the PlantPAx Process Automation System Reference Manual, publication PROCES-RM001.

Installation

The information in this section provides a summary of the installation procedures.

IMPORTANT	For complete installation instructions, including warnings, see **Additional Resources** on page 34.

Installation can be accomplished by utilizing fieldbus connectors. The method is described below.

Transmitter

EtherNet/IP connection version

1 L+
2 L−

2

1

1 Order code for "Power supply", option D: DC 24 V
2 Order code for "Output", option N: EtherNet/IP
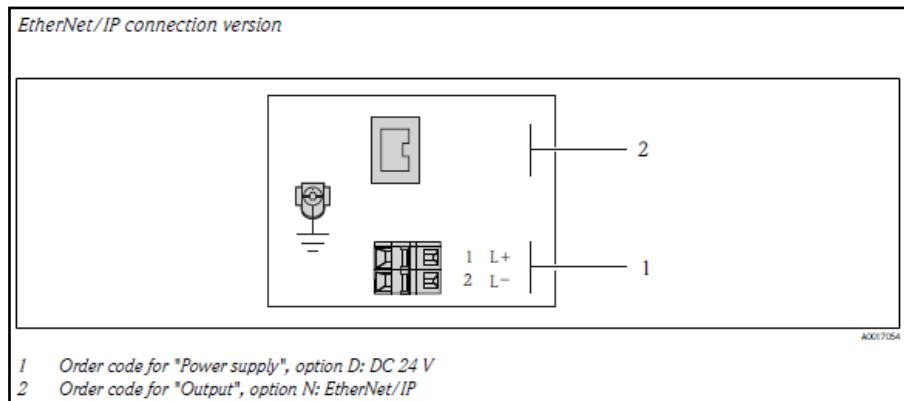
Pin Assignment, Device Plug

Supply voltage for all communication types except Modbus RS485 intrinsically safe (on the device side)

Pin	Assignment		Coding	Connector/ socket
1	L+	DC 24 V	A	Connector
2				
3				
4	L−	DC 24 V		
5		Grounding		

EtherNet/IP (on the device side)

Pin	Assignment		Coding	Connector/ socket
1	+	Tx	D	Socket
2	+	Rx		
3	−	Tx		
4	−	Rx		

Connect a Promass 100 Flowmeter
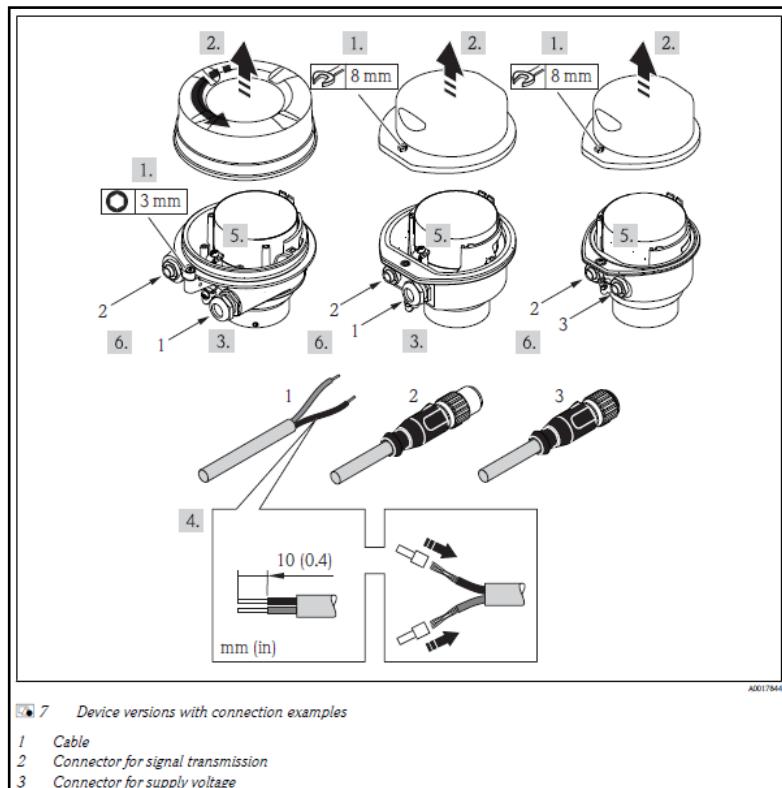
7   Device versions with connection examples

1   Cable
2   Connector for signal transmission
3   Connector for supply voltage

1. Depending on the housing version, loosen the securing clamp or fixing screw of the housing cover, and then unscrew or open the housing cover.

2. Push the cable through the cable entry.

IMPORTANT   To ensure a tight seal, do not remove the sealing ring from the cable entry.

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3. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.

4. Connect the cable in accordance with the terminal assignment or the connector pin assignment.

5. Depending on the device version, tighten the cable glands or plug in the connector and tighten.

IMPORTANT	The degree of protection for the DIP housing is voided if there is insufficient sealing of the housing. Ensure that you attach the screw without using any lubricant. The threads on the cover are coated with a dry lubricant.

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6. Reassemble the transmitter by reversing the removal procedure.

Diagnostic Information via the Light-emitting Diodes

Various light emitting diodes (LEDs) on the main electronics module of the transmitter provide information on device status.

LED	Color	Meaning
Power	Off	Supply voltage is off or too low.
	Green	Supply voltage is OK.
Device status	Green	Device status is OK.
	Flashing red	A device error of diagnostic behavior "Warning" has occurred.
	Red	A device error of diagnostic behavior "Alarm" has occurred.
	Alternately flashing red/green	Boot loader is active.
Network status	Off	Device has no EtherNet/IP address.
	Green	EtherNet/IP connection of the device is active.
	Flashing green	Device has EtherNet/IP address but no EtherNet/IP connection.
	Red	EtherNet/IP address of the device has been assigned twice.
	Flashing red	EtherNet/IP connection of the device is in timeout mode.
Link/Activity	Orange	Link available but no activity
	Flashing orange	Activity present

Configure the Device Address

The IP address of the measuring device can be configured for the EtherNet/IP network through the DIP switches for hardware addressing or through software settings.

The IP address for software addressing is active when the device leaves the factory (default IP address: 192.168.1.212), and all the DIP switches for hardware addressing are set to OFF.

Addressing data

	IP address and configuration options		
1st octet	2nd octet	3rd octet	4th octet
192.	**168.**	**1.**	**XXX**
↓			↓
Can only be configured via software addressing			Can be configured via software addressing and hardware addressing

IP address range	1 to 254 (4th octet)
IP address broadcast	255
Addressing mode ex works	Software addressing; all DIP switches for hardware addressing are set to OFF.
IP address ex works	192.168.1.212 (= software addressing)

Dynamic Host Configuration Protocol (DHCP) Client

If a DHCP server is used within the EtherNet/IP network, the IP address, gateway and subnet mask are set automatically when the DHCP client function is enabled.

The MAC address of the measuring device is used for identification purposes. (See also the connection label.)

The default setting for the DHCP server is ON.

IMPORTANT   The DHCP client function is disabled if hardware addressing is enabled.

Hardware Addressing
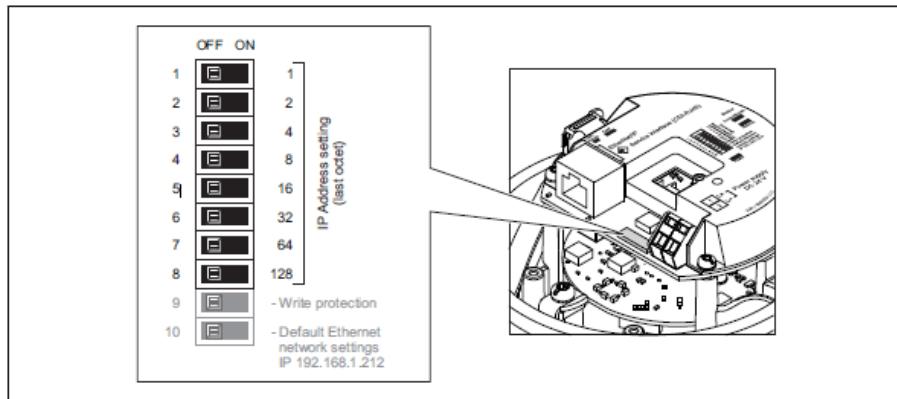
IMPORTANT   The Dual In-line Package (DIP) switches can configure the last octet of the IP address.

1. Depending on the housing version, loosen the securing clamp or fixing screw of the housing cover, and then unscrew or open the housing cover.

2. Set the desired IP address using the corresponding DIP switches on the I/O electronics module.

    Hardware addressing with the configured IP address is enabled after 10 seconds.

3. Reassemble the transmitter by reversing the removal procedure..

Software Addressing

Software addressing is carried out in the Communication submenu, using the navigation path **Setup > Communication in the Web Server**.

When delivered, the measuring device has the following factory settings:

IP address	192.168.1.212
Subnet mask	255.255.255.0
Default gateway	192.168.1.212

IMPORTANT

- If hardware addressing is activated, software addressing is disabled.

- If a switch is changed to the ON position, then the first three octets of the software address are retained.

- If the IP address of the device is not known, the device address currently configured can be read by activating dip switch No. 10, restarting the device and logging on to the Web server.

Install the E+H Promass 100 AddOn Profile (AOP)

An AOP is a way to bring a definition of a new Allen-Bradley device or devices from our Encompass partners into RSLogix 5000. These profiles will vary, depending on the manufacturing and function of the target device. All contain some configuration and automatic tag creation, so you do not have to figure out how data is mapped or spend time creating aliases to point at the generic tags.

This section describes how to install an AOP from Endress+Hauser for a Promass 100 Mass Flowmeter.

Note: The AOP is preinstalled in RSLogix 5000 versions 21 and higher.

1. Download the Promass 100 AOP from http://www.products.endress.com/ethernet-ip-eds.

2. Double click the MPSetup.exe file from the download location.

   The setup screen is displayed.
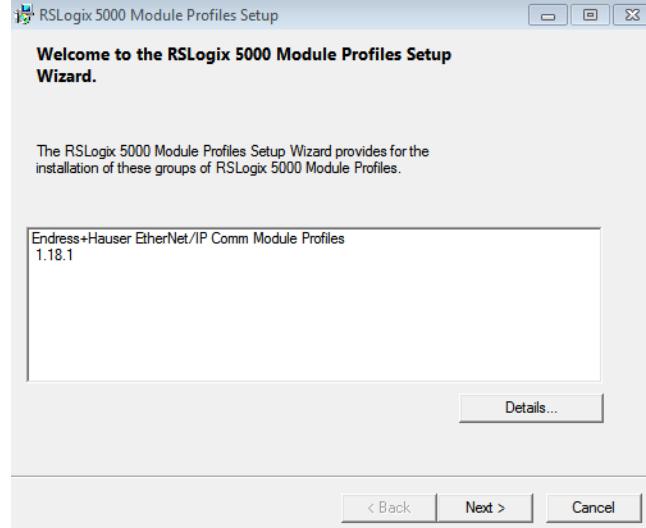
3. Click **Next**, and on subsequent screens, continue to follow the prompts, accepting the default selections and clicking **Next**.

4. When a screen saying that the setup is complete is displayed, click **Finish**.

   The AOP is installed and available to add to the RSLogix 5000 Project, as described in the following section.

Load the Electronic Data Sheet (EDS) File

Although the EDS file for this device is typically included in the installation of the AOP, it is also available for you to install separately. If necessary, you can access it from the device through RSLinx or the Web Server or the manufacturer's website.

If you want to access the EDS file from...	Then...
the device through RSLinx	1. Go to RSLinx, Communication and open the Network view under RSWho. 2. Right-click on the device and select Upload EDS File from device.
the device through the Web Server	1. Go to the Network Configuration screen. 2. Click the button **Load EDS File**.
http://www.products.endress.com/ethernet-ip-eds	1. Download the EDS file. 2. Save the file to your desktop. 3. Double click the file and follow the on-screen prompts.

IMPORTANT   Use the RSLinx EDS Hardware Installation Tool to install the EDS file.

Configure the E+H Promass 100 Flowmeter with the AOP

There are several options to configure the I/O in the Add On Profile (AOP). The option "Device Configuration via the AOP" described in the procedure below is used as an example.

In the RSLogix 5000 project, ensure that the Ethernet Module(s) and communication settings are established before installing the Promass 100. For assistance with setting up Ethernet communications via the ControlLogix Platform, refer to www.rockwell.com or ask the local Rockwell Automation distributor.

Establish the Configuration of the E+H AOP

1. On the left side of the RSLogix 5000 project screen, right click the **Ethernet Module**, and then select **New Module**.
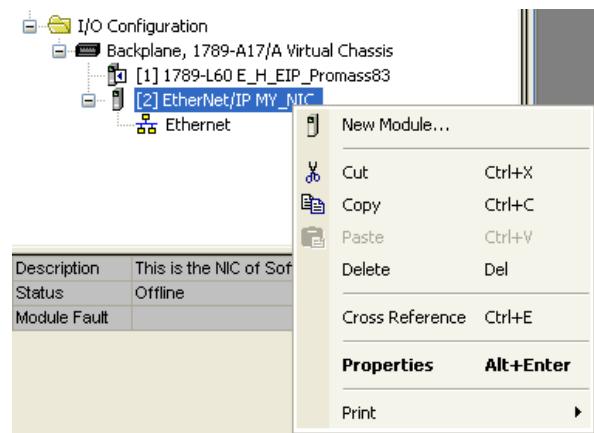
2. Click the **Catalog** tab, select **Promass_100**, and then click **OK**.
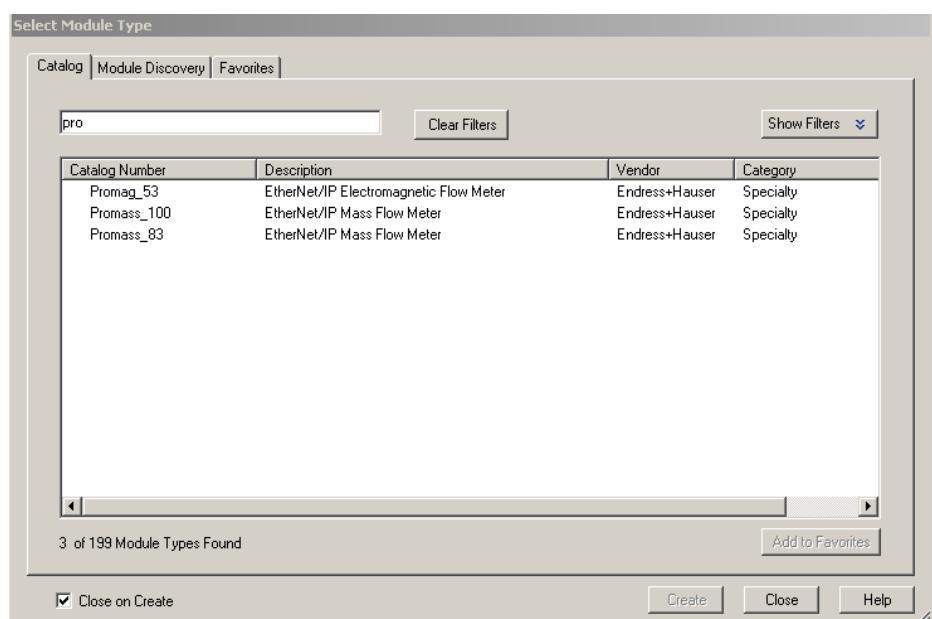
IMPORTANT	Do not click **OK** in the Module Properties screen until you have completed defining the module, as described in steps 3 through 5.

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3. In the Module Properties screen:

   a. Enter the necessary information in the Name and Ethernet Address fields.

   b. In the Module Definition section, click **Change**.
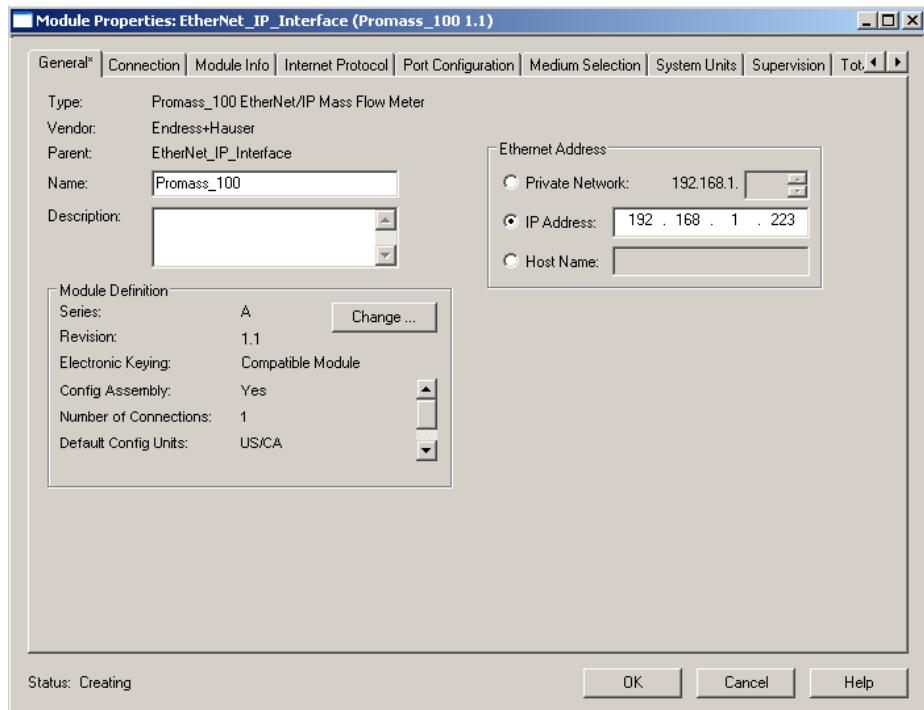
4. In the Module Definition screen:

    a. Click the **Connection Type/s** drop-down list and select **Fixed I/O, Custom Input Only**.

    b. Click **OK**.
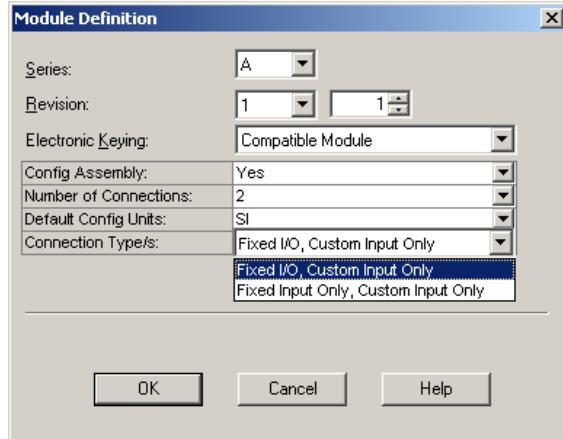
    c. For more information about the available connections in the AOP, refer to the table below:

Config Assembly	Yes* or No	
Number of Connections	1	2
Connections Types	Fixed I/O	Fixed I/O, Custom Input Only
	Custom Input + Fixed Ouput	Fixed Input Only, Custom Input Only
	Fixed Input Only	
	Custom Input Only	

*If using the AOP for device configuration (Config. Assembly: Yes), the configuration in the device is overwritten with every Forward Open command.

If you choose Config Assembly: No then you have to use the Web Server or FieldCare to configure the device.

IMPORTANT	Do not click **OK** in the Module Properties screen, until you ensure that the module properties have the settings that you prefer.

5. If preferred, you can customize the Endress+Hauser Promass 100 AOP properties using the tabs at the top of the Module Properties screen.

- In the **Connection** screen, you can set the Requested Packet Interval (RPI) and other communication parameters.
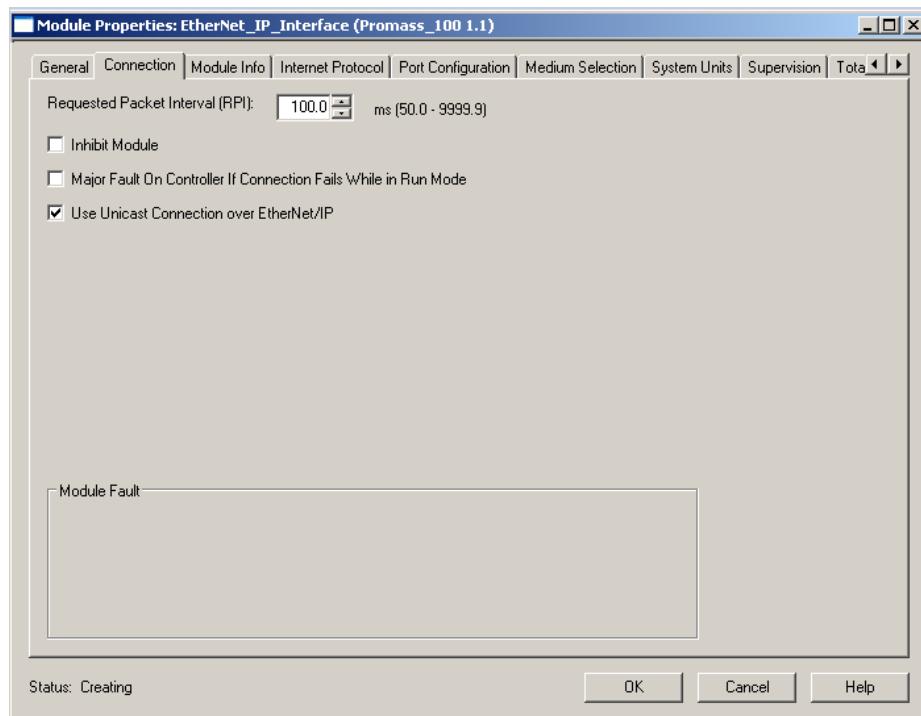
- In the **Module Info** screen, you can view the device information.
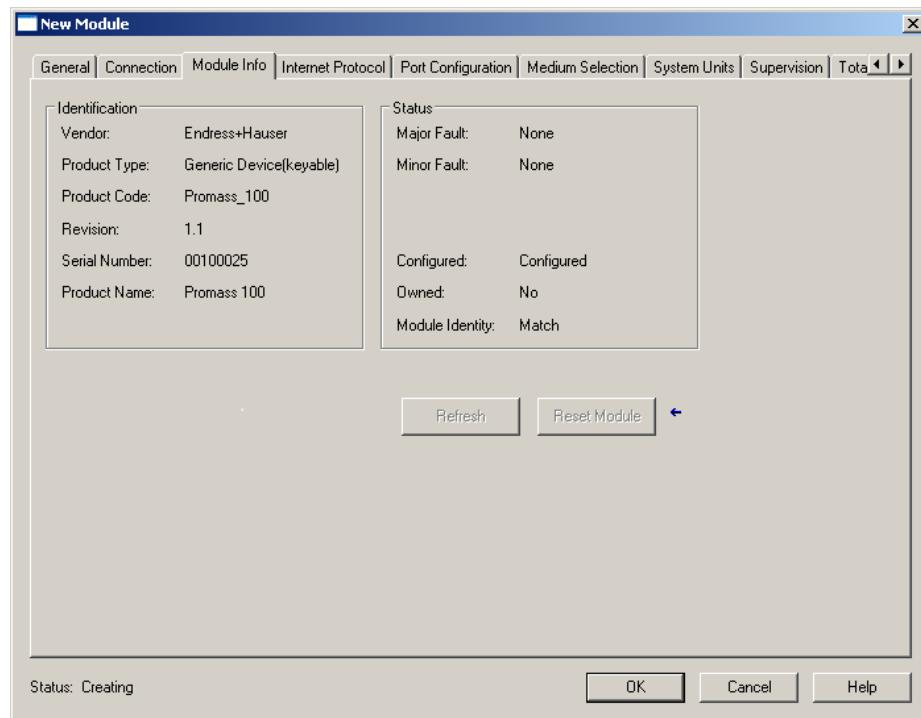
- In the **Internet Protocol** screen, you can set up the Internet protocol.
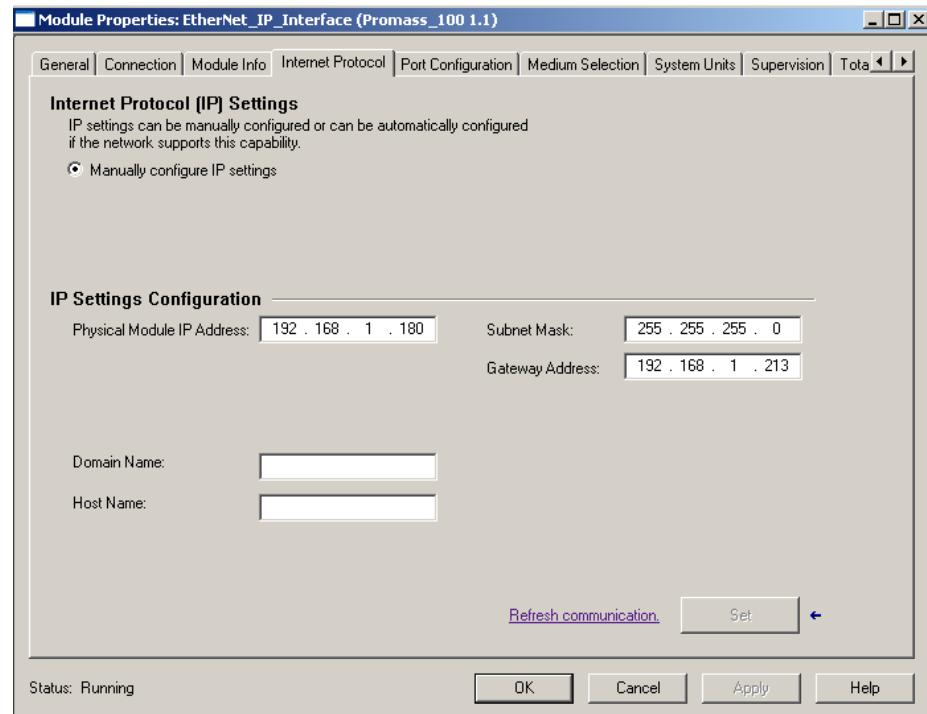
- In the **Port Configuration** screen, you can set up the port configuration.
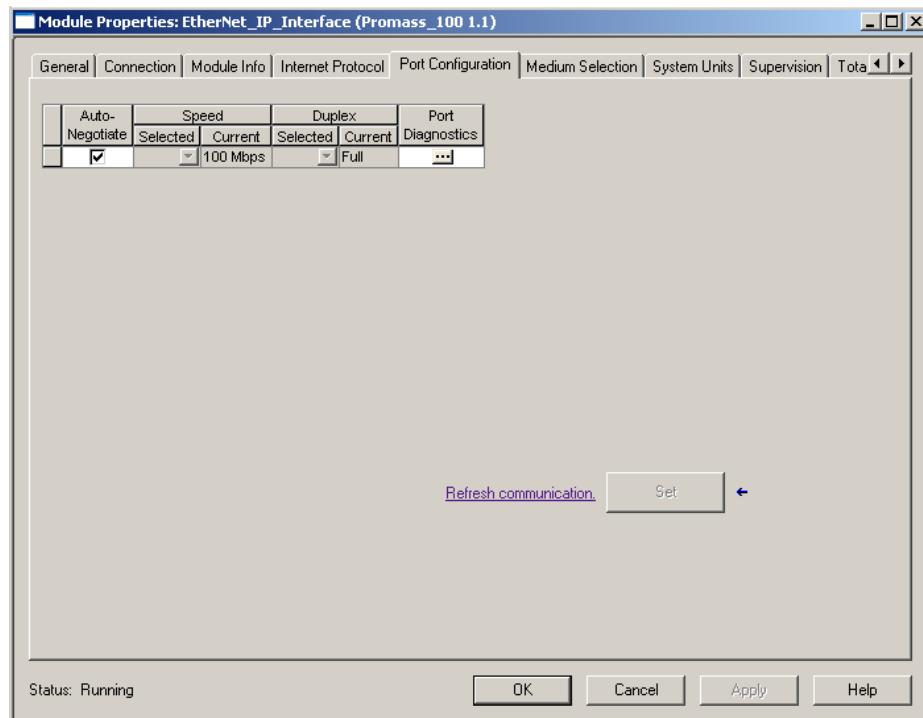
- In the **Medium Selection** screen, you can define the fluid being measured.
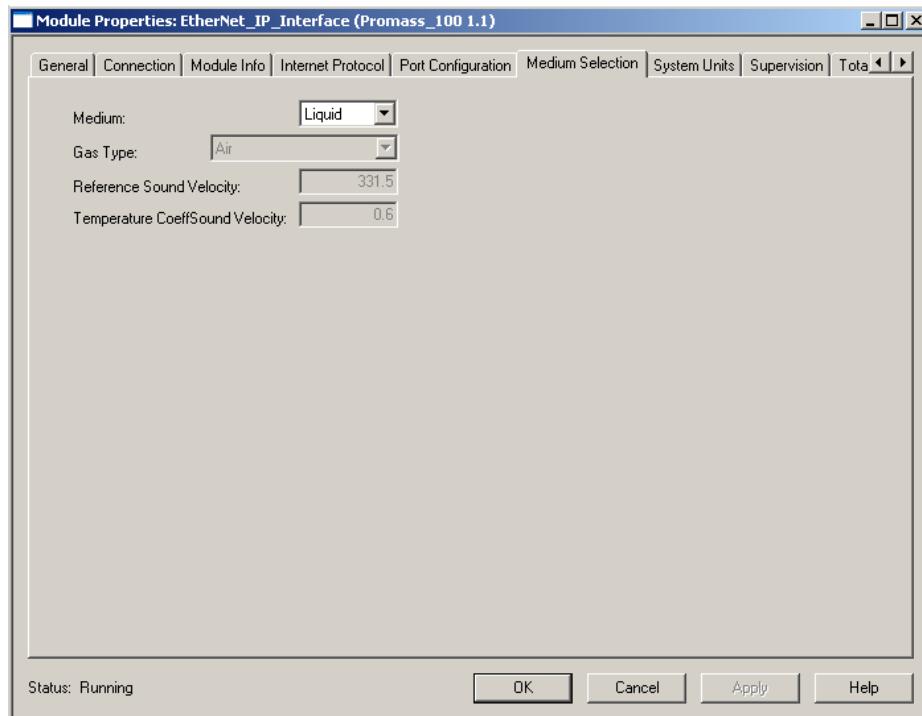
- In the **System Units** screen, you can configure the measuring units.
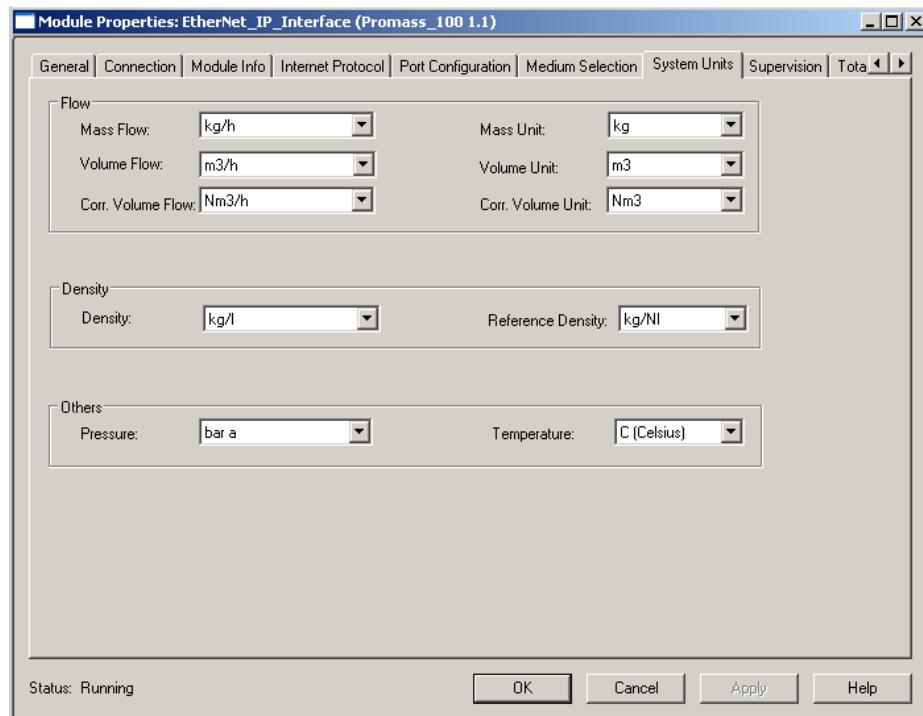
- In the **Supervision** screen, you can configure the diagnostic behavior and Write Protection parameters.
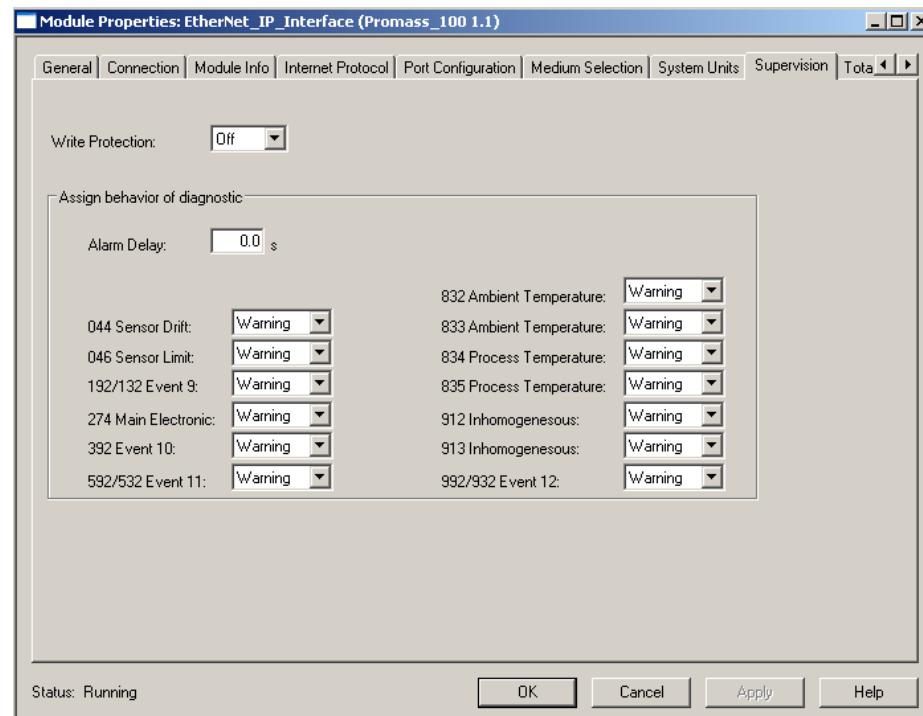
- In the **Totalizers (1,2,3)** screen, you can configure the device totalizers and the measuring units.
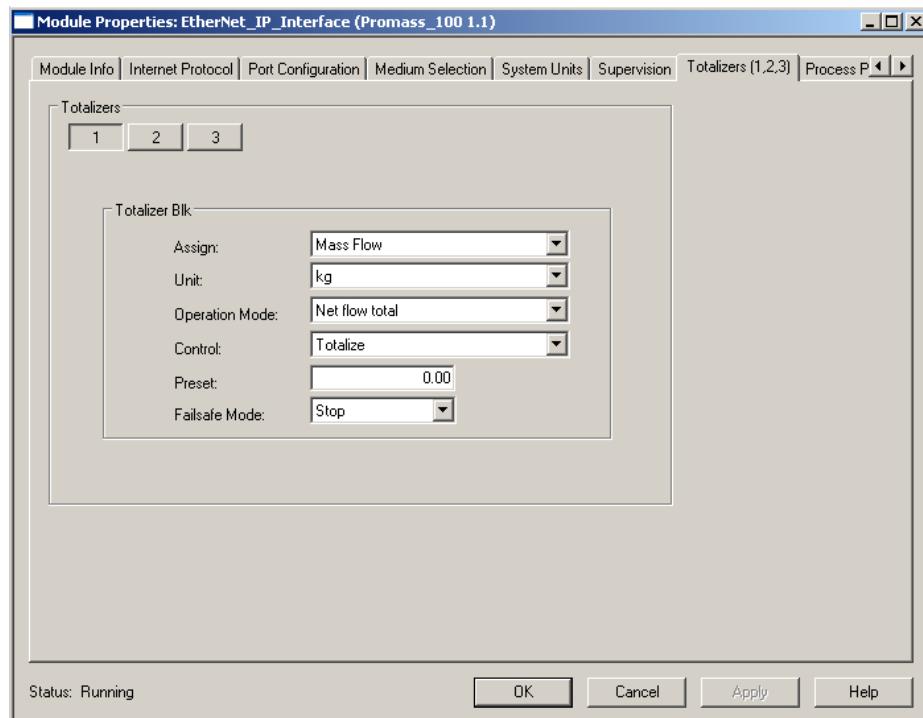
- In the **Process Parameters** screen, you can configure the process parameters such as Flow Override and Density Damping.
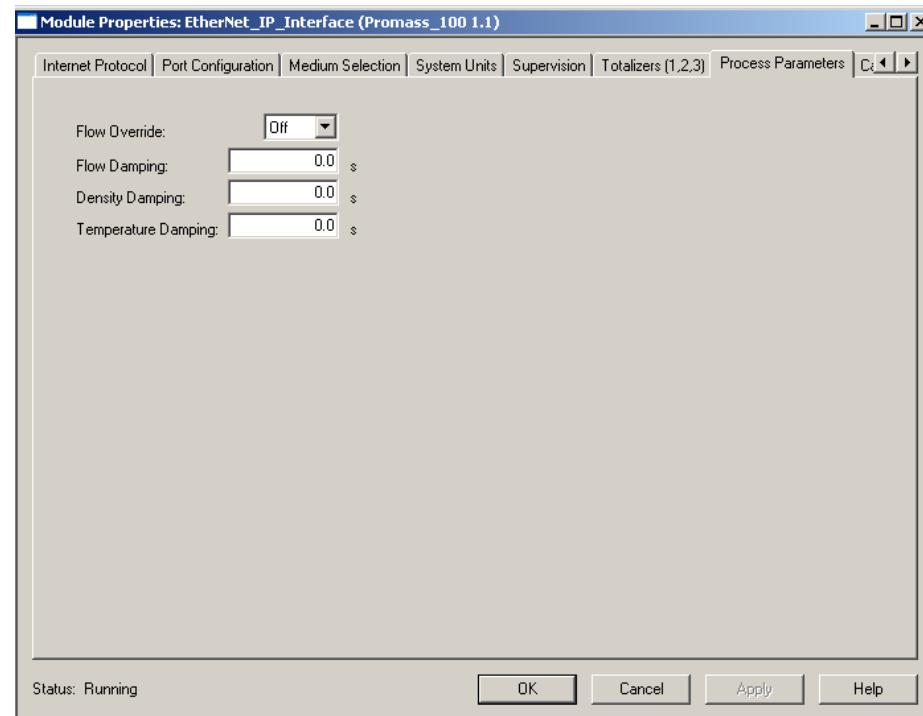
- In the **Calculated Value** screen, you can configure the Calculate Volume Calculation.
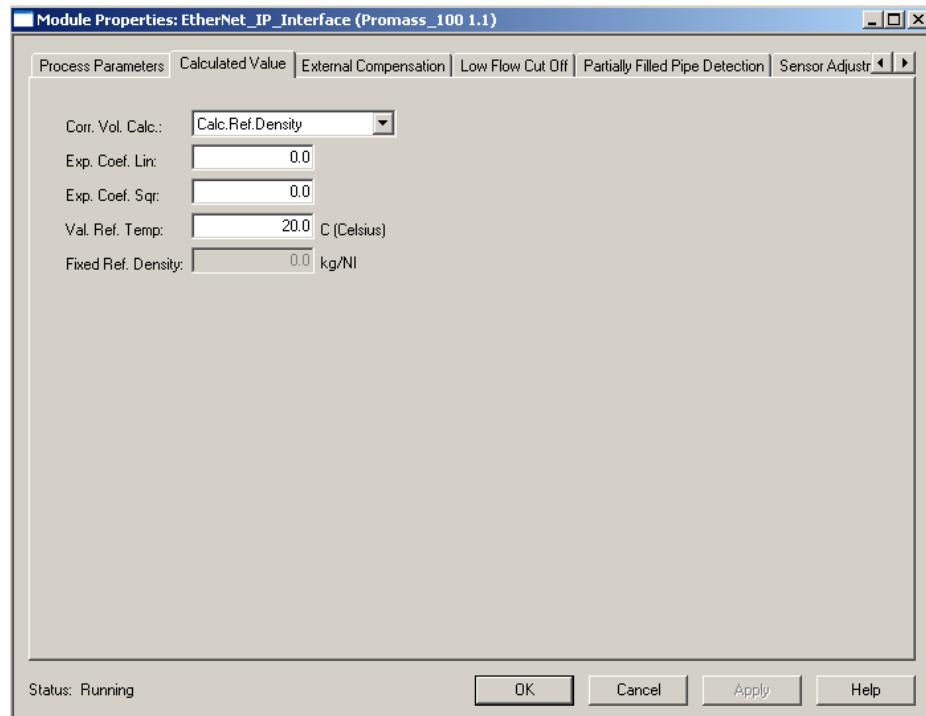
- In the **External Compensation** screen, you can configure the External Compensation method.
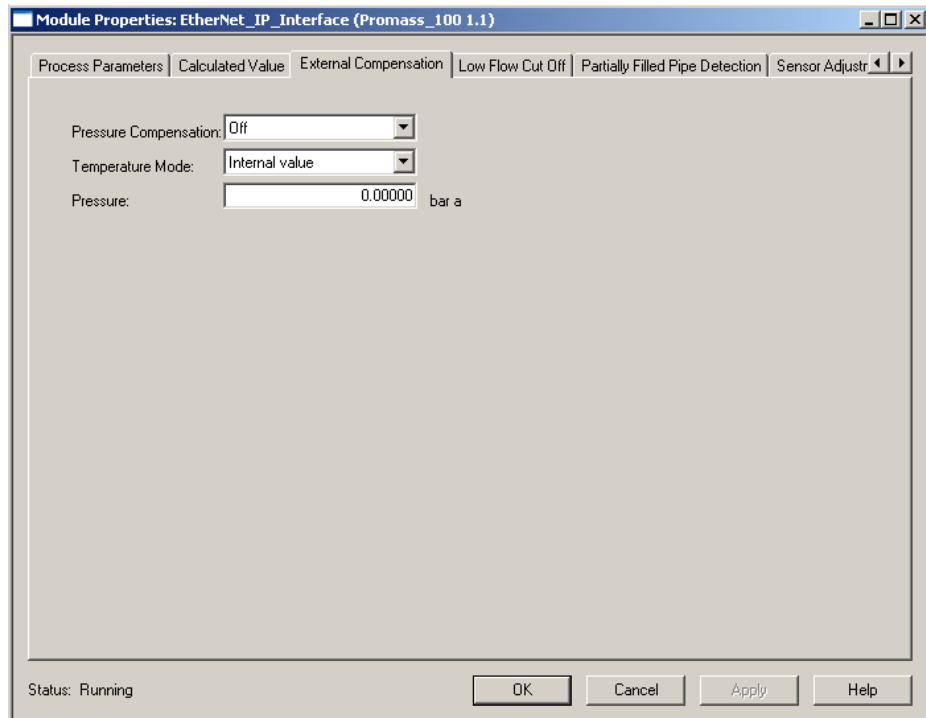
- In the **Low Flow Cut Off** screen, you can configure the Low Flow Cut Off function.
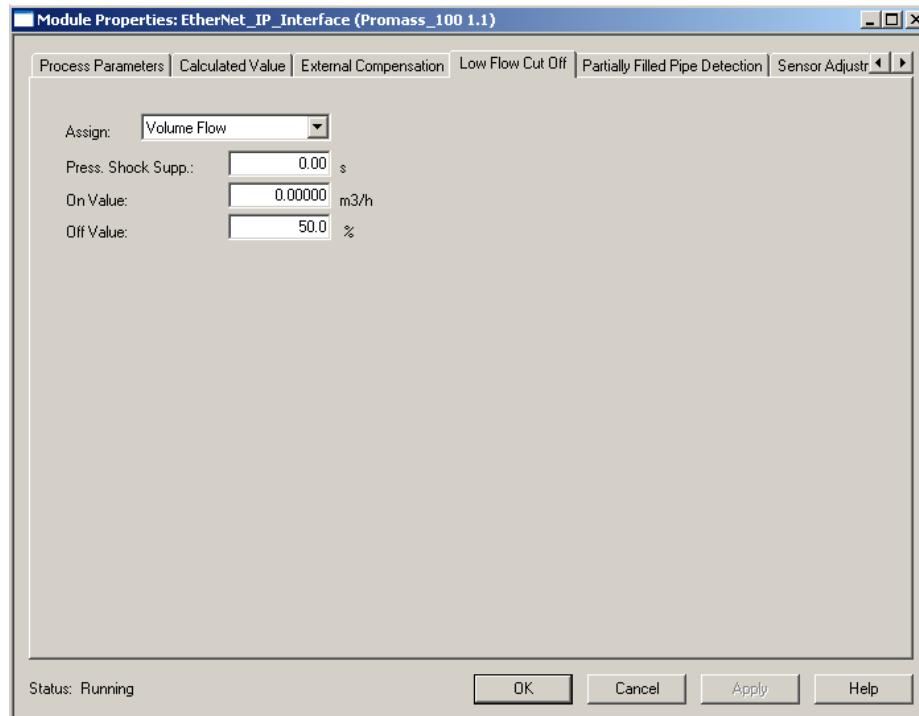
- In the **Partially Filled Pipe Detection** screen, you can configure the Partially Filled Pipe Detection.
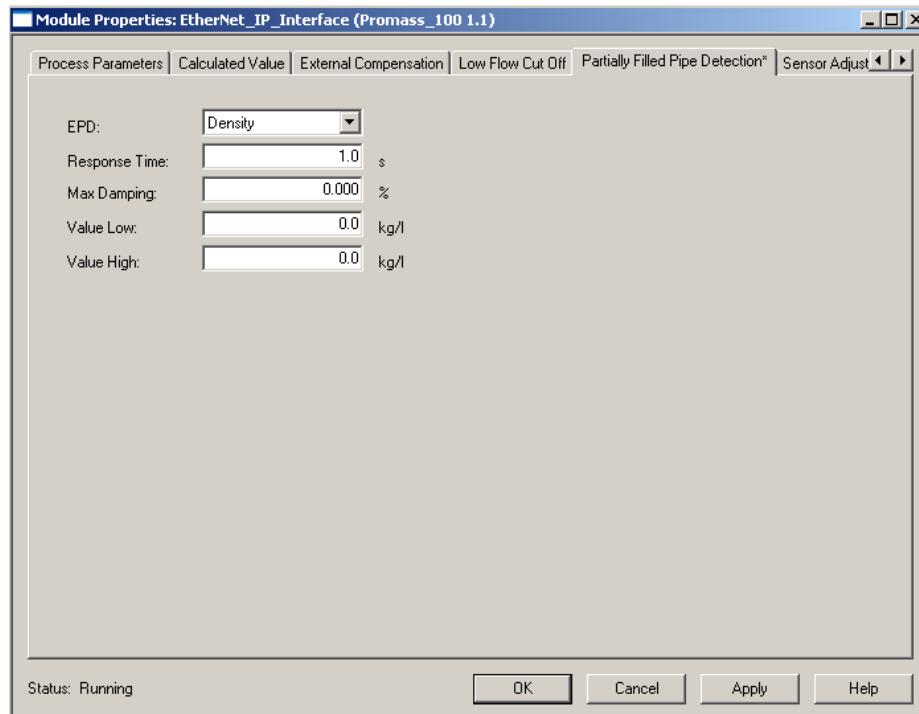
- In the **Sensor Adjustment** screen, you can configure the sensor flow direction.
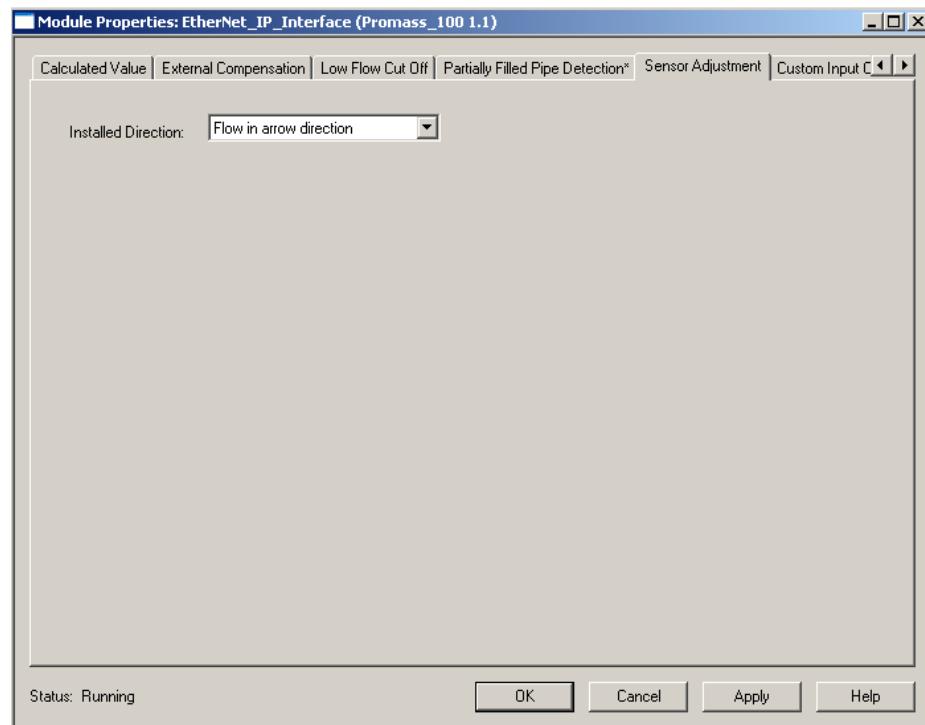
- In the **Custom Input Connection** screen, you can configure the Custom Input connection.
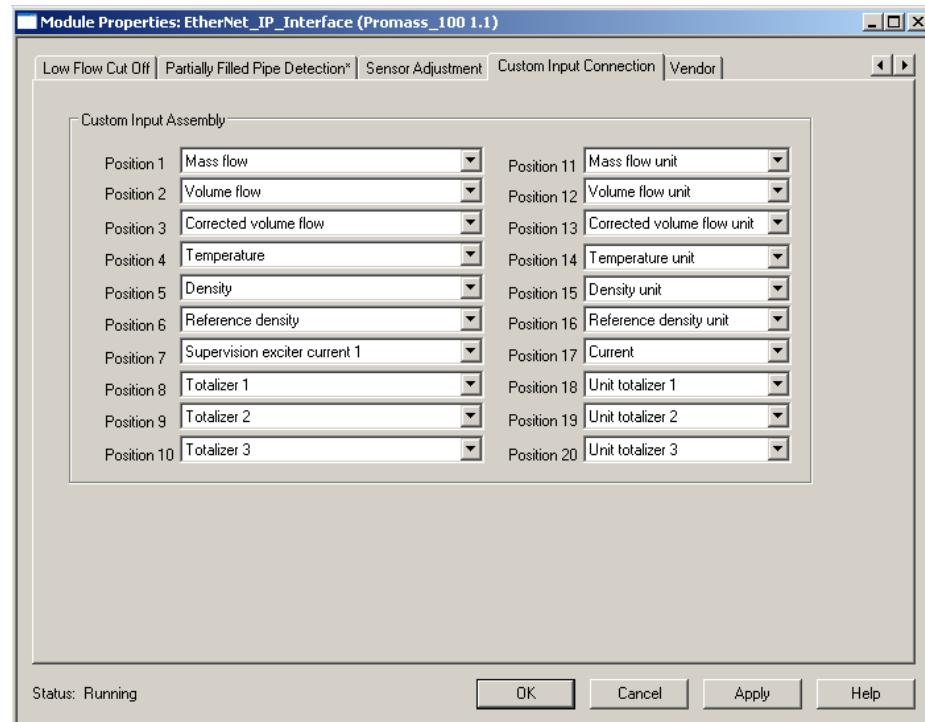
• In the **Vendor** screen, you can view the vendor information.
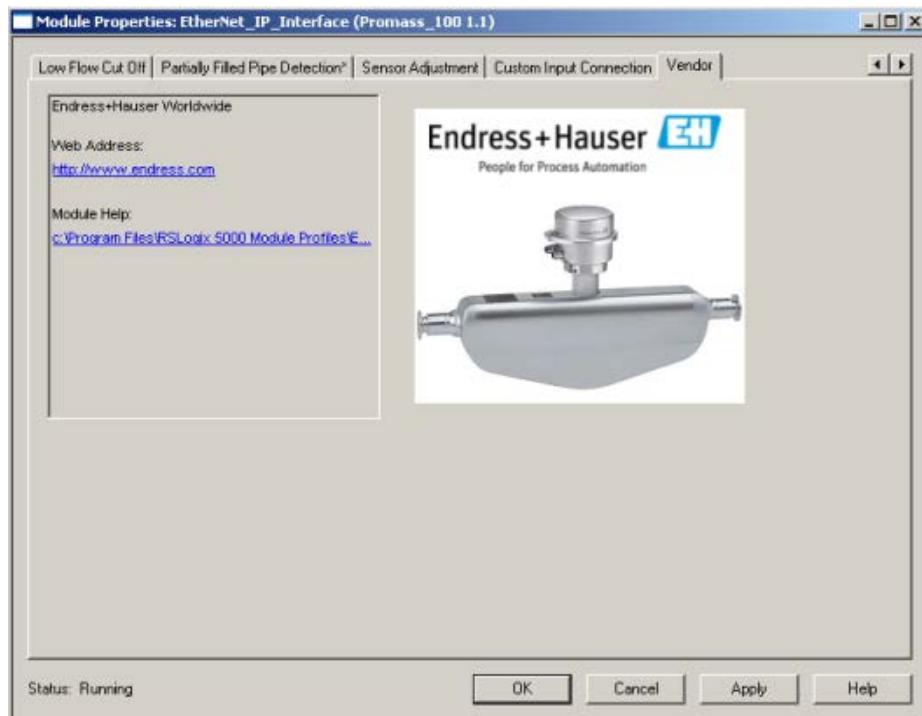
6. When the module is defined according to your preferences, in the Module Properties screen, click **OK**.

7. In the RSLogix 5000 warning screen, click **Yes** to complete the Promass module setup.
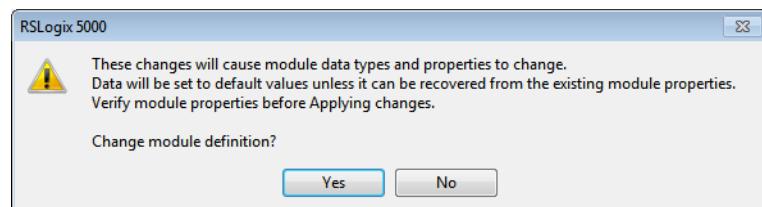
8. Ensure that you save the RSLogix 5000 file first, and then download the file to the ControlLogix controller.

Visualization – Using AOIs and Faceplates

To monitor the instruments using the predesigned faceplates, the EtherNet/IP must be set up as specified in this integration document and the manual. The controller exchanges data between the devices, and the FactoryTalk View SE faceplates notify personnel what is happening in the plant.

The following information allows you to customize the Promass 100 and set up the function blocks to use the Add-On Instructions (AOI) with an HMI server.

See <u>Additional Resources</u> on page <u>34</u> for more detailed information.

Add-On Instructions

An Add-On Instruction exchanges data between each process variable located in the process device and the faceplate installed on a display. The name of the specific instance of the Add-On Instruction becomes the link from the actual instrument to the faceplate on the graphic.

Global Object

A global object links the tag name to the faceplate, provides a touch area for the faceplate to be launched from, and displays the process variables and alarms.
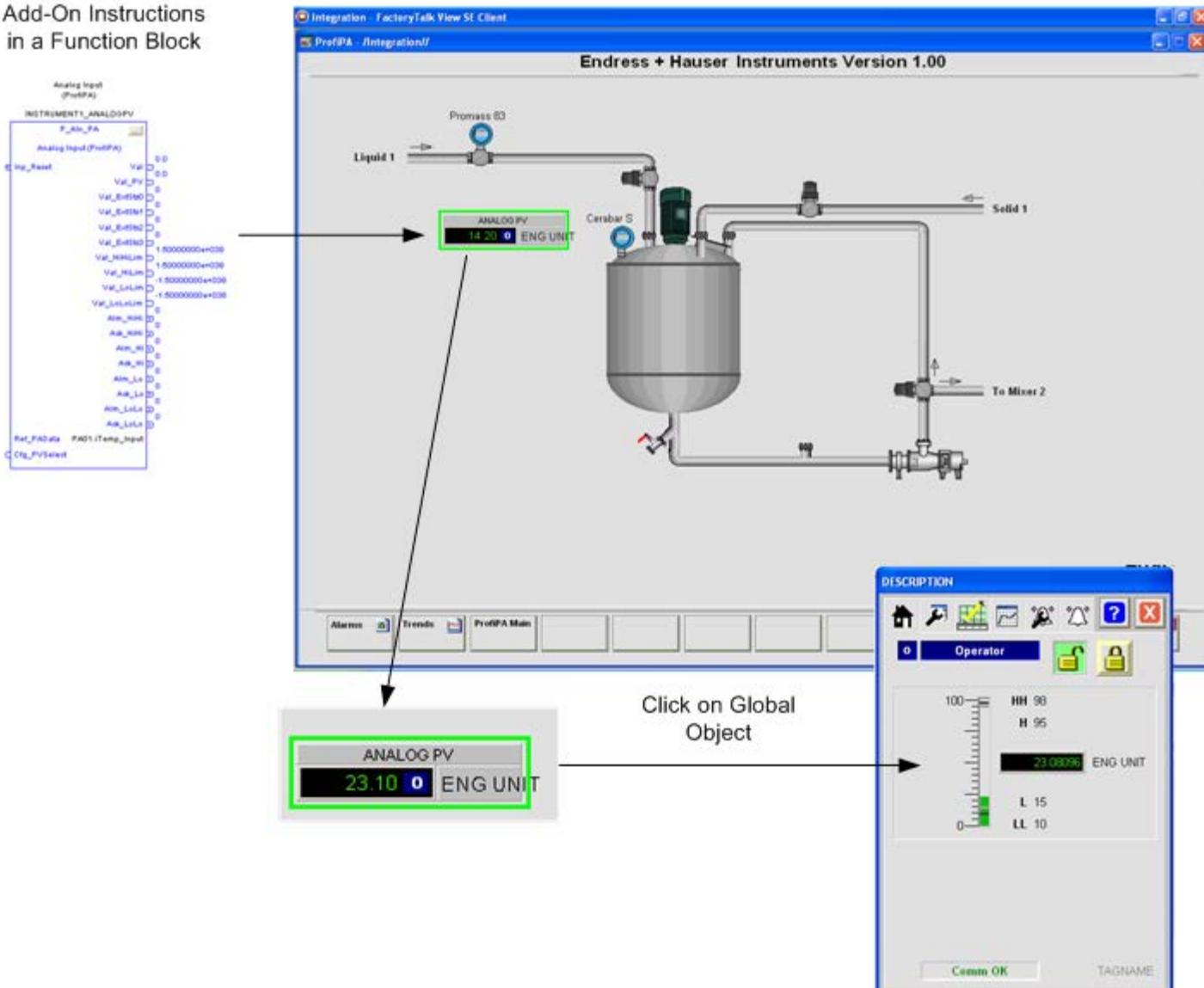
IMPORTANT   A unique global object and faceplate are available for each field instrument due to each instrument having specific extended diagnostics.

Faceplates

The FactoryTalk View SE generic display provides a graphical representation of the instrument based on the information contained within each Add-On Instruction. Navigation buttons at the top of the faceplate change the information displayed. Status displays show information using a bar graph, numeric values, and trend displays. Other displays show specific alarms and warning indications.

Some examples of predesigned faceplates are shown below.
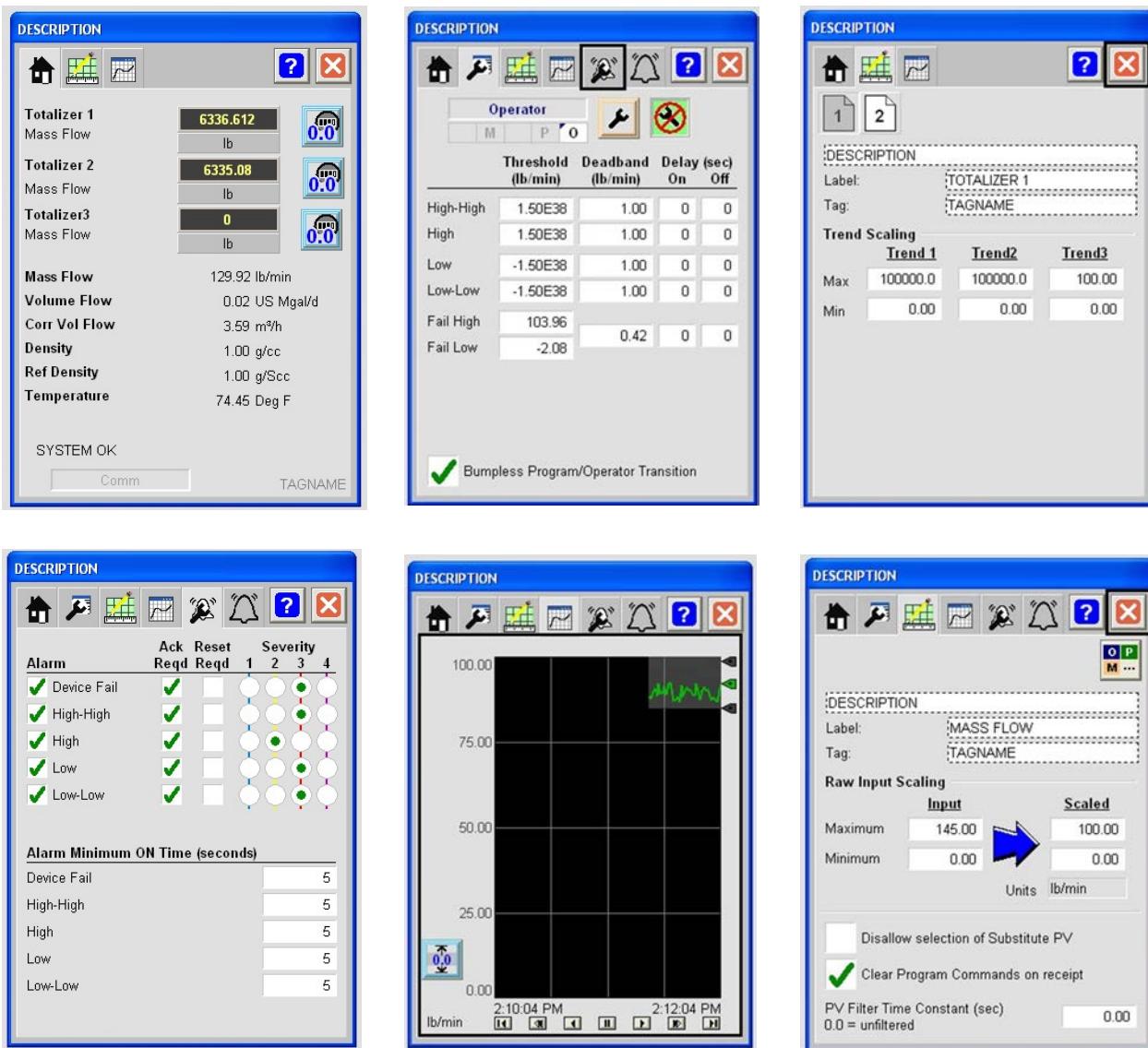
IMPORTANT   A unique global object and faceplate are available for each field instrument due to the display of instrument-specific extended diagnostic information.

The faceplates provide the following information from the device:

- Process values
- PV fault status (communication fault)
- Device extended status

You can configure the faceplates to provide the following information:

- Tag name
- Description
- Engineering units
- Mode (such as operator or program)
- High-high, high, low, low-low alarms
- Over-range and under-range alarms
- Alarm delay
- Alarm hysteresis

Appendix: Configure via Web Server

Configuring the Internet Protocol of the Computer

The device has the following default EtherNet settings:

Note: The factory setting for the device IP address is: 192.168.1.212.

IP address	192.168.1.XXX; for XXX, all numerical values except: 0, 212, and 255 Example: 192.168.1.213
Subnet mask	255.255.255.0
Default gateway	192.168.1.212

1. Switch on the measuring device, and connect it to the computer using the cable.

2. Configure the properties of the Internet protocol (TCP/IP) as defined in the table above.

Starting the Web Server

1. Start the Web Server on the computer.

2. If the IP address of the measuring device is known, enter the defined device address in the address line of the Web browser.

   The login screen is displayed.

1 Device tag
2 Picture of device
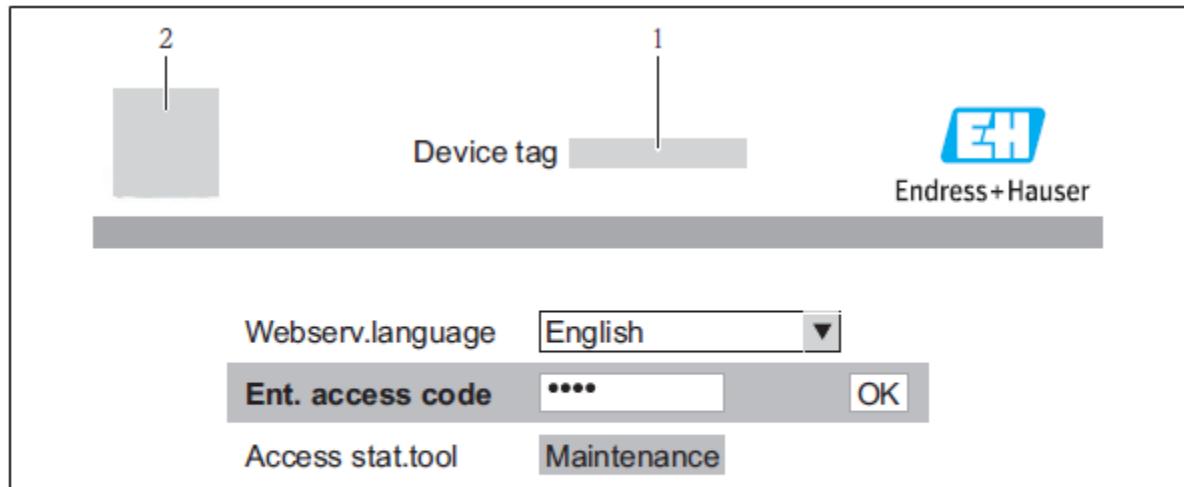
Disabling the Web Server

The Web server of the measuring device can be switched on and off as required using the Web server functionality parameter.

Navigation path
Menu tab → "Expert" menu → Communication → Web server → Web server functionality

Parameter	Description	Options	Factory Settings
Web Server functionality	Switch the Web Server on and off	• Off • On	On

Enabling the Web Server

If the Web server is disabled it can only be re-enabled with the Web server functionality parameter via the following operating options: "FieldCare" operating tool

Additional Resources

Resource	Description
EtherNet/IP Field Instruments	
Proline Promass 100 Technical Information, publication TI01034DEN	Specifications and details of the Promass 100E flowmeter
Proline Promass 100 Operating Instructions (Proline Promass EtherNet I/P) publication BA01065DEN	How to install, wire, configure, and operate a Promass 100 flowmeter
http://www.products.endress.com/ethernet-ip-eds	Download EDS and AOP files for field instrument
http://www.products.endress.com/flow	Information about Endress+Hauser flowmeters
Control System Components	
ControlLogix Controllers Installation Instructions, publication 1756-IN101	How to install and configure a ControlLogix controller.
ControlLogix Controllers User Manual, publication 1756-UM001	How to configure, operate, and maintain a ControlLogix controller.
ControlLogix Ethernet/IP Modules 1756-IN612B-EN-P	Installation Instructions, ControlLogix EtherNet/IP Communication Module
Operator Components	
FactoryTalk View Site Edition User's Guide, publication VIEWSE-UM006	How to design, develop, and deploy FactoryTalk View SE applications
Faceplates, Add-On Instructions, project files, etc. http://rockwellautomation.com/knowledge base (Login required. Please contact your sales representative.)	Download AOIs, Faceplates and Global Object graphics, project files, and documents
Process Control Information	
Integrated Architecture for Process Control System Recommendations Manual, publication PROCES-RM001	Process system recommendations that organize Rockwell Automation products functionally as system elements, which can then be applied in proven, scalable configurations for continuous and batch control
http://www.rockwellautomation.com/process	Information about Rockwell Automation process control and Integration Documents
http://literature.rockwellautomation.com	Available Rockwell Automation publications, including Integration Documents
http://www.endress.com	Information about Endress+Hauser
http://www.endress.com/rockwell	Information about the partnership between Rockwell Automation and Endress+Hauser and the Integration Documents

Notes:

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products.
At http://support.rockwellautomation.com, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://support.rockwellautomation.com.

Endress+Hauser Support

Please refer to your local Endress+Hauser Sales Center for precise information regarding the service support available in your area or visit http://www.endress.com.

Installation Assistance

If you experience a problem within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your product up and running.

United States	1.440.646.3434 Monday – Friday, 8 a.m. – 5 p.m. EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

New Product Satisfaction Return

Rockwell Automation tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor in order to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

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